European Research Studies Journal
Volume XXV, Issue 3, 2022

pp. 665-681

Methods of Modeling the Demand for Resources in the Logistics Sector

Submitted 11/09/22, 1st revision 28/09/22, 2nd revision 19/10/22, accepted 30/10/22

Karol Sikora[1], Rafał Cieślik[2]

Abstract:

Purpose: *Within the framework of this article, the authors review and analyze selected methods of modelling the demand for resources in the logistics industry and application of these methods as a tool to improve efficiency of logistics entities.*
Design/Methodology/Approach: *The general part contains a definition of the logistics sector and its basic characteristics, as well as issues related to determining demand for resources in the broader context of organization management. The detailed part discusses selected methods of modelling the demand for resources, presenting the context of their application and development perspectives of theoretical models for estimating demand for resources.*
Findings: *According to the principle of rational management, enterprises strive for the best possible use of their resources. One of the means to achieve this goal is the proper determination of demand for these resources, resulting from the current scale of operations and expected changes in this area. In the logistics sector, which is an increasingly important element of trade, and in many countries one of the key areas of the economy, the right selection of resources affects both achieved financial results and operational possibilities of providing services.*
Practical Implications: *Results of the review indicate that correct determination of the demand for resources is one of the key factors determining development of a market advantage by individual participants in the exchange of goods.*
Originality/Value: *From the point of view of implementation of long-term goals of logistics companies, strategic analyzes are of key significance, however, short-term analyzes are also important, especially in ensuring current operational efficiency. Regardless of the time perspective, planning models that limit the risk of inappropriate adjustment of resources to the scale of operations, turn out to be useful.*

Keywords: *Material resources, modelling, efficiency, logistics sector, efficiency measurement.*

JEL Classifications: *A19, M20, R40.*

Paper type: *Research article.*

[1]*MA, assistant, Faculty of Management and Technical Sciences, Warsaw Management University, ORCID: 0000-0002-2949-9656, e-mail: karol.sikora@office.wsm.warszawa.pl*
[2]*PhD, assistant professor, Faculty of Management, University of Warsaw, Poland, ORCID: 0000-0002-7933-7700, e-mail: rcieslik@wz.uw.edu.pl;*

1. Introduction

Resource management is one of the basic elements of management. Proper determination of the demand translates directly into both organizational efficiency and achieved economic results. Enterprises taking care of the implementation of basic goals, which are usually defined as development and value growth, increasingly use available tools in the field of modelling the demand for resources. The assessment of efficiency can be considered equivalent to the analysis of relationship between the amount of expenditure and planned or obtained benefits. Proper determination of inputs (resources) affects the outcome.

Due to the fact that enterprises from the TSL sector are one of the key areas of economies of the vast majority of both developed and developing countries, and the development of this sector is strongly related to economic growth, resource efficiency in logistics is of interest to both economic practitioners and academic circles. In this paper, an attempt was made to present available methods of modelling the demand for resources, with particular emphasis on the logistics sector.

2. Characteristics and Importance of the Logistics Sector

In developed countries, logistics is considered to be one of the key sectors of the economy that allows for trade exchange, acting as a bloodstream connecting participants of the trade exchange. The TSL sector is gaining importance with the economic growth observed in individual countries. Additional factors stimulating development are the implementation of innovative technological solutions and increase in the wealth of societies and lifestyle changes. Especially now, in connection with the long-term tendency of increasing importance of international trade, the significance of logistics sector is increasing. This sector also plays a very important role in industrial development and the transport of industrial raw materials (Bardakçi *et al.*, 2020).

In the literature on the subject, there is no unambiguous definition of the logistics sector - analysis of the concept of logistics allows us to conclude that the definitions formulated by famous authors differ in the scope of the processes of physical circulation of goods and information (the scope and object and institutional structure), the way of their treatment and interpretation of specific goals, indicating at the same time, generally similar view on the essence of problems constituting their essential content (Blaik, 2014).

In a narrow sense, logistics covers only entities that provide typical transport services and enterprises that support this area, operating on the market of reloading services, as well as storage and replenishment of stocks. As a result of significant market changes, including, in particular, the liberalization of activities in markets that have previously operated as state monopolies (including postal services, rail transport) and as a result of expanding the scope of enterprises' activities to include

services traditionally of interest to production and trade entities (Jeszka, 2013) the importance of this sector is systematically growing. When analyzing the activities of TSL sector, it can be noticed that it includes a group of enterprises that differ both in terms of the offer of services and the range of operations or size (Jeszka, 2013). On the other hand, observed increasing complexity of logistics processes in the supply chain justifies the fact that logistics sector is gradually expanding, simultaneously increasing the turnover and share in GDP every year.

Due to the observed strong differentiation of logistics companies, it is natural that we deal with activities of large and small entities, offering both simple logistics services, from operations at the executive level, to logistics management services, from transport, storage, confectioning and packaging services, to forwarding services and comprehensive supply chain services. The sector is growing, increasing its share in generating the national economy's income (Jeszka, 2013).

It should be noted that research indicates a relationship between economic growth and logistic development in a given country and a correlation between the World Bank's Logistics performance index and economic growth in G-7 countries (Bardakçi *et al.*, 2020). The logistics services market is also growing thanks to the increasing tendency to use third party logistics services and resulting expanding number of logistics operators within the 3PL (third part logistics) model - this is particularly evident in industrializing countries, where production is an important part of the economy (Wang *et al.*, 2008).

It should be noted that transport is currently considered one of the four pillars of globalization, along with communication, international standardization and liberalization of trade (Jugović *et al.*, 2015). As their operations develop, logistics operators conclude strategic agreements, and make mergers and acquisitions. Network enterprises are established, often transnational, which change the picture of logistics services market (Neumann *et al.*, 2000). It is also visible in the tightening situation in the field of (international) competition, which requires even closer links between enterprises and the market; along with the expansion and integration of the European (world) market, enterprises are more and more often forced to flexibly react to logistically diversified preferences of customers (Blaik, 2014).

Assigning a company to the TSL industry is related to the proper recognition of services it provides. The literature on the subject contains many definitions of a logistics service, and consequently there is no universal explanation for this concept. The definition and scope of logistics services have changed along with development of the industry from the traditionally understood transport sector, including transport, forwarding and postal services, through packages of logistics services including warehouse services, inventory management and additional services, later the concept of chain and network management and optimization was adopted. deliveries based on close cooperation of logistic operators with production and

trading companies, up to individualized logistic services supported by integrated ICT systems (Jarocka *et al.*, 2018).

Logistics services can be defined both synthetically as services involved in the processes related to the planning, implementation and control of the flow of raw materials, products, services as well as information and financial resources between the point of origin and the point of destination in order to meet customer requirements in an effective and efficient manner (Srivastava *et al.*, 2013) or emphasizing the complexity of solutions offered as services supporting the flow of materials and goods from producers to consumers, as well as the related waste disposal and return flows, including activities undertaken on their own by service users and the activities of external entities (Tseng *et al.*, 2005).

To sum up - the transport services market is a deliberately organized, relational system between its subjective and objective elements, the real processes (purchase-sale) and regulatory processes (procedures supporting their implementation) take place (Rucińska *et al.*, 2004).

3. Identifying Resource Requirements as a Key Management Issue

Each organization has tangible and intangible resources, they are - one could say - the inherent content of every company. For the development of an enterprise, these resources should be properly configured (Stankiewicz, 2010). Due to the fact that modern enterprises must be profitable, as these are the conditions of existence in a market economy, and, moreover, the overriding goal of the activity should be to maximize value for owners (Masztalerz, 2008), it should be remembered that achieved results depend both on external environment of enterprises, as well as internal conditions, the most important of which are related to equipping the enterprise with various resources and ability to use them (Stankiewicz, 2010).

In this context, it is worth mentioning that there are several types of resources: i.e. renewable (only the number of units at any time is limited), non-renewable (only consumption in each time period is limited), twice limited (both the number of units at any time and consumption are limited), resources that are discreetly and continuously divided, and appropriated and unappropriated (Węglarz, 1981).

Regardless of the type of resources, planning activities are the means for effective use of owned resources (and planned to be acquired). Planning, apart from organizing, coordinating, leading and controlling, is one of the basic management functions (Fayol, 1930). In its simplest form, planning means setting your organization's goals and determining how to best achieve them, while decision-making, as part of the planning process, involves selecting a course of action from among the set of options available. Planning and decision making therefore help to maintain management efficiency by providing guidance for future actions (Grifin, 2002).

Planning can be of a different nature and relate to both the short, medium and long term. Taking into account this diversity, the complete planning process should be taken into account, especially in the context of determining the demand for resources necessary to achieve plans resulting from the company's mission, from which strategic goals will be derived, and in shorter perspective – tactical goals. Strategic goals are the main building blocks in the development of tactical plans, which are then operationalized, becoming the basis for deliverables and operational plans (Grifin, 2002).

The level of resources necessary in an enterprise is related to the goals of a particular company. Objectives in the activities of an organization fulfill four important functions, first of all, they constitute a guideline and give a uniform direction to the activities of people working in the organization - the set goals allow to understand where the company is heading. Secondly, the practice of setting goals influences planning by creating a kind of symbiotic system, because effective goal setting promotes well-thought-out planning, which in turn facilitates identifying future goals.

Thirdly, goals can be a source of motivation for employees (which may lead to better use of material resources) and fourthly, goals enable implementation of effective evaluation and control mechanisms, providing tools for the application of effective models in this area (Pająk, 2006), so it can be concluded that properly and detailed defined goals directly affect the correctness of determining the demand for resources in the enterprise. The amount of natural resources and human resources involved, determine the volume and quality of goods and services offered on the market. Availability of resources, as well as the level of production factors (including labour factor) at the disposal of the enterprise, directly determine the volume and quality of products on the market. This, in turn, determines the competitive position and competitiveness of the enterprise (Łączyńska *et al.*, 2010).

In order to ensure the availability of products (which can take the form of both finished products and services), enterprises are forced to plan future resources. The current tendencies consisting in the increasing individualization of the offer (resulting from the changing needs reported by the market) mean that determining the capacity of production system must be based on both stable demand and ad-hoc demand. Consumers expect products and services to be available in ever shorter time.

In addition, IT systems and flexible production processes lead the market towards mass adaptation to customer needs. As a result, companies use the concept of a quick response in their activities in order to meet customer requirements as part of their logistics functions. (Kotsifaki, 2007).

Planning is constructing alternative versions of the future development of the enterprise. The main elements of the resource strategic planning cycle include:

analysis of the external and internal environment, shaping the mission of the organization, developing long-term goals, detailing them by specifying short-term goals, analysis and selection of strategies (Wallace *et al.*, 2008).

Strategic resource planning is necessary to formulate long-term development plans of the enterprise and identification of long-term solutions in order to achieve a competitive advantage. The use of strategic planning allows for assessment of the company's potential, development of production programs, setting specific goals for the departments of the company (Frolov *et al.*, 2020), therefore it can be stated that a strategic plan is a kind of framework or a series of signposts keeping the operational plan on the right path to achieving goals. From the management point of view, after developing the strategy and defining the company's goals, you can proceed to the creation of an operational activity project, specifying broadly understood resources (Dwiliński, 2020).

Operational plans are derived from tactical plans and their task is to achieve operational goals. Operational plans are therefore focused on a narrower range of issues, have a relatively short time horizon and involve lower-level managers (Grifin, 2002). In addition, the advance shaping of processes and resources creates the need to plan operational activities and budgets for corporate responsibility centres (Kaplan *et al.*, 1996). Anticipating establishment of processes and resources indicate the need to plan operational activities and budgets for corporate responsibility centers (Kaplan *et al.*, 1996).

An equally important element from the point of view of determining the demand for resources, is the production capacity associated with the maximum production volume (level of provided services) that can be produced (performed) in a specific time (Waters, 2001). On the other hand, referring to the definition of production capacity, also identified as the resources of the production system, determining whether it is possible and at what time to produce what the customer requires, we come to the dilemma of how to balance production possibilities with market expectations.

The lack of this balance results in losses incurred by the company, either due to unused production capacity, or due to the inability to meet the needs of customers, which may even result in the necessity to pay contractual penalties in the event of failure to fulfill the already accepted orders (Pająk, 2006). Obviously, maintaining a balance between customer expectations and the scale of the company's operations (understood as the amount of resources involved) should also be a point taken into consideration in trade and service enterprises.

It is worth remembering that the purpose of planning is not to show the accuracy of predicting the past, but to determine what needs to be done today to have a future (Skalik, 2001), which is why logistics companies increasingly rely on proven

theoretical models for estimating demand on resources as a factor enabling achievement of the company's business goals.

4. Theoretical Models of Resource Demand Estimation

Proper design of the service chain planning process is critical to the smooth running of companies from service industries such as telecommunications, utilities and logistics. It involves optimizing resources against expected demand in order to maximize use and minimize waste, which in turn maximizes revenues while minimizing costs. More and more often it is associated with the automation of the planning process (Ainslie *et al.*, 2016). Logistics is increasingly driving the success of industrial organizations in global markets.

Globalization has brought not only the potential of the global market, the disruption of market barriers and the free flow of capital, but also global competition and the hitherto unknown speed of market turbulence. The current effort of designers of modern logistics systems is, when designing these systems, to build in their features the ability to quickly adapt to changing market conditions. These systems are now called adaptive logistics systems, which exploit, to ensure adaptability, new types of technology also based on computer emulation (Furmanna *et al.*, 2017).

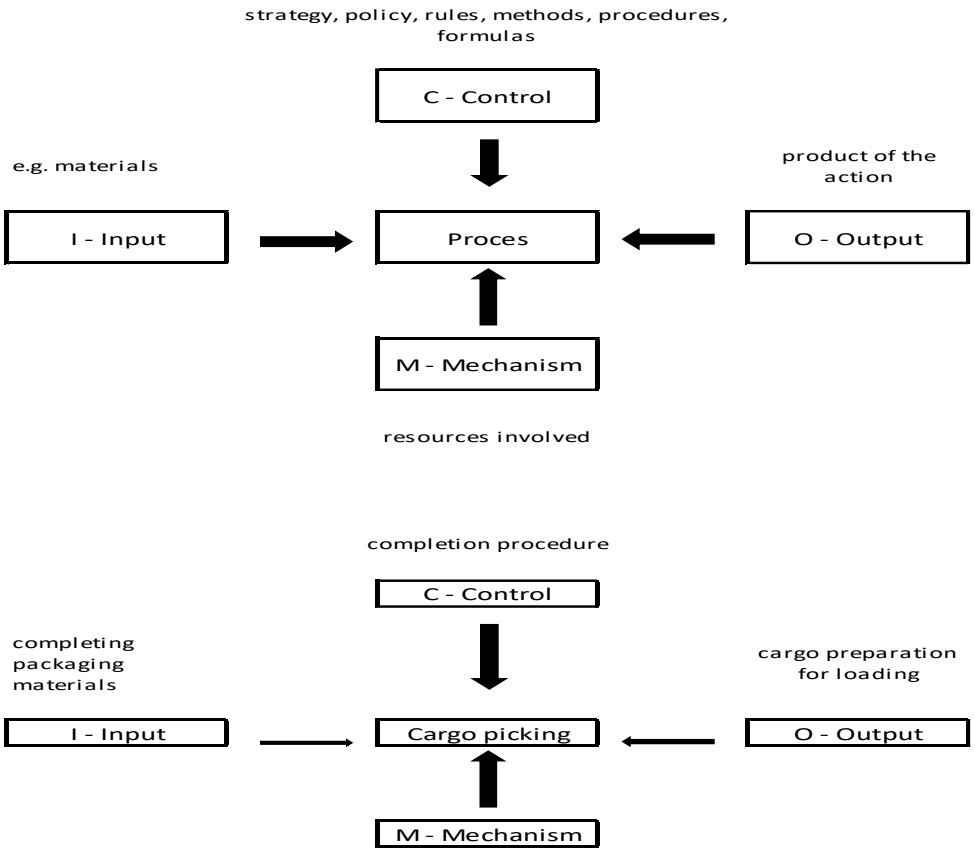
Creating models of processes and operating systems and simulating their behavior in quasi-real conditions enables the analysis of economic results (e.g., costs, profitability, financial liquidity and demand for working capital) and operational results (e.g., productivity, efficiency, reliability, level of resource use), before making final investment decisions and before incurring financial liabilities. It is a pre-emptive action to redesign the processes or organizational structures of the company. The need for modeling and simulation is directly related to the need to improve the functioning of an economic entity and maximize its value.

Creation of such models results from the need to test action scenarios and variants of organizational solutions as well as methods and parameters of operational management at the planning stage (Śliwczyński, 2015). Analysis of all possible variants is usually not possible (Roubens, 1981), and the synthesis of operational factors of processes and resources in the supply chain allows only the selection of a poly-optimal variant (i.e. not worse than any of the others). In practice, this means determining a satisfactory solution from among the admissible options, and not the best one (Śliwczyński, 2015).

The formula for the level of satisfaction determined for the variant evaluation criterion is consistent with the principle of satisfaction by Herbert A. Simon (Simon, 1990), according to which companies do not seek optimal and difficult solutions, but realistic and satisfying ones (Śliwczyński, 2015). In decision-making mechanisms, satisfaction thresholds are set for a given criterion and the variant is selected that is sufficiently satisfactory in terms of the adopted criteria (Simon, 1979).

For a comprehensive description and analysis of processes (treated as transformation systems) in the network of dependencies of the resource flow system, you can use the analysis methodology and the ICOM description rule (I - Input, O - Output, C - Control, M - Mechanism) (Weckenmann, 2006).

Figure 1. *The methodology of analysis and the rule for describing ICOM processes (actions, operations, activities)*



Source: *Own elaboration based on (Śliwczyński, 2015).*

The impact on the flow of resources and the product of each process (e.g. material needs planning, ordering, transport, storage) includes measuring the output of the process (Output), measuring and influencing the process input streams (Input), realization resources (Mechanism) as well as methods and parameters of process control (Control) (Śliwczyński, 2015).

The process map, graphically presenting the workflow, is a starting point for the analysis and evaluation of incremental value of the process and the basis for

selection of efficiency improvement methods. When analyzing values, process maps made with the use of a number of process notations are used, e.g., BPMN (Business Process Model and Notation), DFD (Data Flow Diagram), IDEF (Integration DEFinition language), UML (Universal Modeling Language), VSM (Value Stream Mapping) i), LVSM (Lean Value Stream Mapping). The material flow management model uses the SCOR (Supply Chain Operation Reference-Model) process approach methodology.

The importance of the SCOR model and its suitability for modeling the flow of resources results from its universal approach to managing various configurations of supply chains (within different business profiles and sectors of the economy and industries) as well as the methodology of network thinking. The elements of the SCOR model are: planning (resource flow management), procurement (resource ordering), execution (resource processing or service content creation), distribution (storage and transport of finished products) (Simon 1990). Exploiting the combined SCOR and ICOM logic, one can observe the supplier-customer relationship at every stage of the resource flow.

Thus, the elements of the chain may be different participants of economic exchange, from producers and their suppliers, through logistic operators, to recipients. This general model of resource flow management includes detailed models of individual operational functions. The first of them, i.e., the S&OP (Sales and Operations Planning) planning model, is created on the basis of a sales forecast and long-term demand for the products / services offered by the company.

As part of the S&OP model, the sales plan is transformed into planning operations in the supply chain (the demand for products on the target market is transferred to the level of planning the flow of products from production, taking into account the algorithms: demand management, balancing production resources, verification of financial results and covering the needs of operating capital). Based on data from S&OP, the following are modeled: transport system resources, outsourcing and warehouse resources.

Other models are: ordering model (enabling multi-variant analysis according to established resource needs), generator of actual consumption with the forecast update algorithm (including the estimation of the actual consumption of specific resources), ordering method verification model (used for multi-criteria analysis leading to the selection of satisfactory solutions according to the set criteria values), transport system model, storage model and operational controlling model (efficiency analysis model) (Śliwczyński, 2015).

As mentioned above, it is usually not possible to precisely define the structure of fixed and current assets (especially in the long term), striving to achieve the required flexibility of the production and supply chain's potential in relation to the volatility of the market demand. The Vester method (Kowalska, 2001) (combined with the use

of an impact matrix) can be used for a comprehensive analysis of the impact of operational activities in the supply chain and resource allocation on the value of the product.

In general, the inverse relationship of the two basic functions of value creation - flexibility for the customer and efficiency and productivity for the enterprise - creates a trade off relationship between them and causes the need to control the level, place and time of maintained flexibility in the supply chain (Łączyńska *et al.*, 2010).

Bearing in mind that the priorities for value factors, determining the urgency of work shaping the processes responsible for them, result from arrangements with customers, product competitiveness analysis or the results of controlling analyzes focused on higher profit of the enterprise, work on product value analysis and shaping processes and resources in the supply chain are a continuous task, most often carried out according to the Deming PDCA cycle methodology (Łączyńska *et al.*, 2010).

For transport logistics, it is important to solve the following classes of tasks: operational transport planning, selecting carriers, shaping loads, calculating the order of deliveries, modelling and calculating alternative routes, solving Drop & Hook problems, however, the stability of the transport management system is determined not only by how well these tasks are solved, but also how the tasks related to tactical and strategic level of management are dealt with, considered precisely in terms of the Deming model. Therefore, there are currently a number of planning challenges to which a qualitative response promises a good business response, and the application of the D, C, A phases becomes a good solution to the tactical and strategic level of enterprise management.

Due to the cyclical and iterative nature of PDCA, it helps to correct errors and prevent them in the future. The purpose of the Deming cycle is to identify errors and their root causes as part of process optimization in subsequent iterations. As more and more solutions are tested and successfully implemented, data and experiences are also collected to help understand the process.

Using PDCA in this way, the Deming cycle is more than a problem-solving method, as it can provide valuable information from various processes in the enterprise, including the resource demand planning process, which is essentially based on working in a cycle analogous to the Deming cycle. That is, establishing a resource demand plan, executing it, identifying deviations and their causes, and introducing optimization solutions to be used in the next approach to resource demand planning.

Another possible approach to modelling is the Digital twin technology concept, which is a functional system for continuous optimization of logistics processes. Its quintessence is the combination of real logistics with its own digital "copy". This

creates a digital factory environment where the company can optimize logistics directly during the production process, change the parameters and configuration of logistics in real time. The data generated during this time create a complete picture of logistics in the company.

This data is collected and compared to a digital pattern on an ongoing basis. It allows, among other things, to shorten and improve the resource handling process, optimize logistic processes and improve the efficiency of employees providing logistic processes (Furmanna *et al.*, 2017). It seems that the Digital twin technology concept will play an important role in future intelligent production systems, where the manufactured product will behave as an intelligent unit in production.

This unit will be able to communicate with the environment and will be able to organize its processing fully autonomously. Such a product will itself determine the sequence of its processing, it will allocate the required capacity in the competence cells and it will call mobile robotic systems as well as conventional logistic resources to ensure its transport in production.

Therefore, it is extremely important to create the already mentioned virtual copies of real elements of production and logistics systems, which will be based on relative autonomy, and their behavior will be similar to the behavior of intelligent, living organisms. The Digital twin concept is based on the planning provided by the projection and planning system. This system represents an intuitive, team design of logistic systems. It is based on a technology platform that is integrated into the entire chain of the Digital twin concept.

The projection planning system includes evolutionary algorithms that provide a new way of solving complex optimization problems in logistics. These problems are too complex for traditional computational techniques and give no useful results or are not applicable at all. The applied algorithms use heuristic methods and stochastic phenomena when searching for an optimal or suboptimal solution to a logistics concept (Plint, 2016; Dulina, 2003).

To sum up, modeling the demand for resources in enterprises is carried out both with the use of traditional planning methods based on the knowledge and experience of management staff and with the use of more advanced mechanisms. Thanks to the combination of SCOR and ICOM logic, we gain insight into the supplier-recipient relationship at every stage of the flow of resources, which enables their effective planning and use. In turn, in the model based on the Deming cycle, we focus on an iterative approach to resource planning and the systematic improvement of the quality of this process.

However, the future seems to be solutions similar to Digital-twin, enabling a very comprehensive approach to analysis and working in real time on very large data sets. The main goal of the development of planning models should be to create tools

supporting managerial decisions both in the area of shaping the resource flow management system and the processes implemented in it. Only such feedback will ultimately have a positive impact on the improvement of the efficiency of entities using it.

5. Discussion - The use of Modelling as a Tool to Improve Efficiency of Logistics Entities

Economic efficiency based on the theory of economics and organizational efficiency are the two main pillars of the perception of efficiency (Lisiecka, 2017). Efficiency is one of the properties determining the essence of an enterprise as an economic entity, it determines the functioning of the organization and influences its development (Osbert -Pociecha, 2007). In the literature on the subject, you can find many measures of effectiveness, in the classic sense, efficiency (also called productivity, performance or effectiveness) is defined as the ratio of benefits achieved to the costs incurred.

In the logistics sector, efficiency reflects the pursuit of an appropriate structure of processes and costs as well as an appropriate level of customer service. Thus, logistics has an impact on the structure of the added value and the structure of outlays necessary to create this value (Mesjasz-Lech, 2012). By extending the concept of efficiency with elements of competitiveness determining the ability to compete on the market, it can be assumed that it is the ability - both in the operational and strategic dimension - to adapt to changes in the environment and to effectively use the resources available to carry out specific tasks (Penc, 1997).

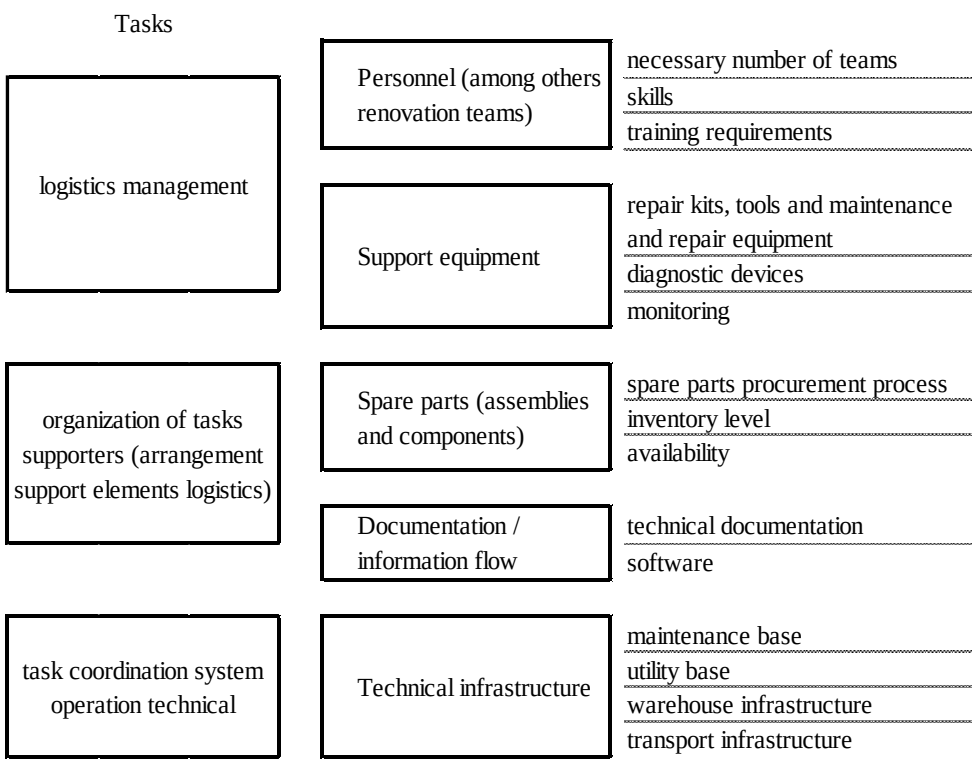
Then being efficient in an operational sense comes down to recommending that one acts much better by doing what others are doing, following the same concept of action (Ejdys, 2014). On the other hand, in the strategic dimension, achieving a satisfactory level of effectiveness is associated with acting in a different way, implementing a unique concept of action. In a turbulent environment, it is not sufficient to be effective only in an operational sense to achieve the basic goals of the enterprise (duration and development). It is also necessary to be effective (efficient) in a strategic sense (Osbert -Pociecha, 2007).

Bearing in mind that modern economic systems are shaped by many factors, logistical support must fit in with the requirements of general conditions and adapt to them. The inherent features of the changing economic environment is a need for continuous optimization and improvement of efficiency, which is reflected, inter alia, in in that: "right time" is getting shorter, "right place" is getting more distant, "accepted costs" are getting lower, "right quality" is getting higher, "right volume" and "right materials" must be delivered exactly as ordered (Chaberek, 2020).

The basic tasks of exploitation system, or more precisely - its servicing subsystem, boil down to ensuring the continuity of operation of technical objects (e.g.,

machines, devices or means of transport). The implementation of this goal is necessarily related to the flow of materials, energy, information and personnel. All these necessary resources are delivered and discharged by an appropriate logistic support system, thanks to which it is possible to maintain the continuity of the operation processes (Werbińska, 2008). On the other hand, limiting the tasks of logistics only to the problem of ensuring necessary resources in the process of operation of the technical system, we can distinguish five basic elements of logistic support (Werbińska, 2008).

Figure 2. *Elements of logistic support of the technical system.*



Source: *Own elaboration based on (Werbińska, 2008).*

Detailed scope of operational data for the purposes of shaping processes and the level of resources includes: the assortment structure of resources, including their characteristics, in terms of defining specific business requirements. Thanks to the use of planning models, it becomes possible to determine requirements for individual elements of the logistics infrastructure.

Considering that significant value of assets of enterprises located in the operational resources of the supply chain (a significant share of production machinery and equipment, storage facilities and equipment, etc. in the value of total fixed assets of enterprises), it justifies the need to analyze the use of resources in servicing the flow of goods and sales. In this context, it is obvious that controlling and operating analysis mainly includes the study of the impact of operating decisions, e.g. on the profitability of assets, capital and sales, asset turnover (both fixed and current) as well as asset productivity (Łączyńska *et al.*, 2010).

The concept of value is at the heart of logistics. According to Ballou (Ballou, 1999), logistics is about creating value. Values for customers and suppliers as well as for other stakeholders of the company. Value in logistics is expressed in terms of time and place. Products and services are worthless unless they are in the hands of the customer when (time) and where (place) he wants to consume them. Good logistics management perceives every action in the supply chain as contributing to the value-adding process (Ballou, 1999; Lambert, 1998).

Since value analysis is based on a systemic and analytical study of the influence of all factors on the value of the product (the tested value) in order to reduce costs and increase the value in use of the product for the customer, it fits perfectly into the system of measuring and evaluating effectiveness. Value analysis is also used to eliminate ineffective methods of using resources and to implement actions that do not add value. It is useful for solving complex economic and technical problems and creating value for products.

Therefore, it requires analytical tracking of the methods of implementation of processes (including activities) and the use of resources, including studies of supply systems, production and co-production, distribution and their mutual relations, as well as the conditions for the implementation of activities in all supply chain processes responsible for creating the value of the final product (Łączyńska *et al.*, 2010).

According to Harvard Business Review, (hbr.org, 2017) about two-thirds of business strategies planned for implementation fail, making effective planning and logistics strategy critical to the company's success. A comprehensive logistics strategy should cover the strategic, operational, and tactical levels of logistics planning as well as the four focal points in the supply chain, including facility locations, customer service levels, and inventory and transportation decision making.

6. Conclusion

In a free market economy, consumer demand determines the provision of specific goods and services by enterprises. Consumers colloquially speaking "vote" with money, expressing through what they want to buy. It is related to the freedom of choice (Friedman, 1962). Manufacturers offering their products must, therefore,

submit to the will of customers, indicating "what to produce", otherwise the latter will benefit from competitive offers (Platje *et al.,* 2018).

On the other hand, the question "how to produce" is related to the costs and efficiency of production technology. When labor costs increase, the use of physical capital (machines) becomes more advantageous, especially in the case of mass production (Platje *et al.,* 2018). The above dilemmas of "what to produce" and "how to produce" are related to the demand for individual factors of production. Tangible and intangible resources at the disposal of enterprises are a decisive factor in the effectiveness of achieving intended goals. Regardless of whether they are owned or supervised by an organization, they require an estimation of future demand both in the long and short term.

Due to the fact that the logistics sector is not homogeneous and there are small entities and international corporations as well as highly specialized companies providing only a narrow range of services (e.g., transport services), various planning methods will be applied to enterprises offering comprehensive services from simple incremental plans to advanced mathematical predictive methods supported by dedicated IT solutions. Nevertheless, regardless of the scale or scope of activity, each rationally managing enterprise estimates the demand for future resources and takes steps to improve the methods used.

To sum up, the methods of modelling the demand for resources in the logistics sector are an extensive issue, so far analyzed in a rather limited way in terms of the use of specific theoretical models for estimating the demand for resources. With this framework, the authors makes an appropriate review, reducing the research gap in this area.

References:

Ainslie, R., McCall, J., Shakya, S., Owusu, G. 2016. Predictive planning with neural networks. In: Proceedings of the International joint conference on neural networks (IJCNN), 24-29 July, Vancouver, Canada. Piscataway: IEEE [online], 2110-2117.

Ballou, R.H. 1999. Business Logistics Management, 4th eEition. New Jersey, Prentice Hall International.

Bardakçi, H., Erdoğdu, A., Batut, A. 2020. Relationship between Logistics Performance, Economic Growth and Financial Development in G-7 and E-7 Countries. İnsan ve Toplum Bilimleri Araştırmaları Dergisi, 9(5), 4166.

Blaik, P. 2014. Logistyka. Koncepcja zintegrowanego zarządzania. Warsaw, PWE 475 s. ISBN 978-83-208-2180-2.

Chaberek, M. 2020. Ład logistyczny w gospodarowaniu. Gdańsk, Wydawnictwo Uniwersytetu Gdańskiego.

Dulina, Ľ., Malcho, M., Mičieta, B. 2003. Optimal utilization of the employees potention in the manufacturing condition. In: Annals of DAAAM for 2003 and Proceedings of the 14th International DAAAM Symposium: Intelligent manufacturing and automation: Focus on reconstruction and development, 129-130.

Dwiliński, L. 2002. Zarządzanie produkcją. Warszawa, Oficyna Wydawnicza Politechniki Warszawskiej.

Ejdys, S. 2014. Optymalizacja miejskiego transportu zbiorowego na przykładzie miasta Olsztyna. Uniwersytet w Białymstoku - Wydział Ekonomii i Zarządzania.

Fayol, H. 1930. Industrial and general administration. London, Sir I. Pitman & sons, Ltd.

Friedman, M. 1962. Capitalism and freedom. University of Chicago Press, Chicago.

Frolov, K., Iliashenko, V., Ershova, A. 2020. Strategic Procurement of Resources for Transportation: Architectural and Methodological Issues. TransSiberia 2020 Conference, Transportation Research Procedia, 54, 945-952.

Furmanna, R., Furmannováa, B., Więcek, D. 2017. Interactive design of reconfigurable logistics systems. TRANSCOM 2017: International scientific conference on sustainable, modern and safe transport. Procedia Engineering, 192, 207-212.

Grifin, R.W. 2002. Podstawy zarządzania organizacjami. Warszawa, Wydawnictwo Naukowe PWN.
https://hbr.org/2017/11/executives-fail-to-execute-strategy-because-theyre-too-internally-focused.

Jarocka, M., Wang, H. 2018. Definition and classification criteria of logistics services for elderly. Engineering Management in Production and Services, 10(4), 65-75. DOI:10.2478/emj-2018-0023.

Jeszka, A.M. 2013. Sektor usług logistycznych w teorii i praktyce. Difin, Warsaw.

Jugović, A., Komadina, N., Hadžić, A.P. 2015. Factors influencing the formation of freight rates on maritime shipping markets. Sci. J. Marit. Res., 29, 23-29.

Kaplan, R.S., Robert, S., Norton, D.P., David, P. 1996. Linking the balanced scorecard to strategy. California Management Review, vol. 39, no. 1.

Kotsifaki, M., Dimitriadis, N., Ketikidis, P., Misopoulos, F. 2007. Logistics strategic planning: Current status and future prospects in Greek companies. International Journal of Risk Assessment and Management, 7. 10.1504/IJRAM.2007.011409.

Kowalska, K. 2001. Controlling w zarzadzaniu przedsiebiorstwem. Dąbrowa Górnicza. Wydawnictwo WSB w Dabrowie Górniczej.

Lambert, D.M., Stock, J.R., Ellram, L.M. 1998. Fundamentals of Logistics Management. London: Irwin/McGraw-Hill.

Lisiecka, M. 2017. Kategoria efektywności wobec współczesnych wymagań definicji i pomiaru, Przedsiębiorstwo we współczesnej gospodarce - teoria i praktyka. Quarterly Journal No 3/2017, (22).

Łączyńska, K., Górecka, K., Wojtasik, P. 2010. Analiza wybranych obszarów konkurencyjności wygranych liderów międznyarodowych na polskim rynku TSL w latach 2006-2007. Zeszyty Naukowe Wydzialu Ekonomicznego Uniwersytetu Gdańskiego. Ekonomika Transportu Lądowego, Nr 39. Gdańsk, Wydawnictwo Uniwersytetu Gdańskiego.

Masztalerz, M. 2008. Value as an Overriding Goal of an Enterprise. Studia Doktorantów – Akademia Ekonomiczna w Poznaniu, nr 3, 174-183.

Mesjasz-Lech, A. 2012. Wybrane problemy pomiaru efektywności działalności logistycznej. Logistyka 2/2012.

Neumann, C.S., Ringbeck, J., Schwegmann, V. 2000. Best practice in logistics. McKinsey Quarterly, Issue 3.

Osbert -Pociecha, G. 2007. Relacja między efektywnością a elastycznością organizacji. Prace Naukowe Akademii Ekonomicznej we Wrocławiu.

Pająk, E. 2006. Zarządzanie produkcją. Produkt, technologia, organiacja. Warszawa, Wydawnictwo Naukowe PWN.

Penc, J. 1997. Leksykon biznesu. Warszawa, Wydawnictwo Placet.
Platje, J., Paradowska, M., Kociszewski, K. 2018. Ekonomika trnasportu - teoria dla praktyki. Wrocław, Wydawnictwo Wyższej Szkoły Bankowej we Wrocławiu.
Plinta, D., Krajčovič, M. 2016. Production system designing with the use of digital factory and augmented reality technologies. In: Advances in Intelligent Systems and Computing, vol. 350, 187-196.
Roubens, M. 1981. Preference relations on actions and criteria in multiple criteria decision making. European Journal of Operational Research, vol. 10, 51-55.
Rucińska, D., Ruciński, A., Wyszomirski, O. 2004. Zarządzanie marketingowe na rynku usług transportowych. Gdansk, Gdańsk University Publishing House.
Simon, H.A. 1979. Rational decision making in business organizations. American Economic Review, 69, No 4, 493-513.
Simon, H.A. 1990. Invariants of human behaviour. Annual Review of Psychology, 41.
Skalik, J. 2001. Organizacja i zarządzanie. Wrocław, Wydawnictwo Wyższej Szkoły Zarządzania i Finansów we Wrocławiu.
Srivastava, S.K., Chandra, Ch. 2013. A road map for internal reforms and other actions required to enhance exports in logistic services from India, 2-34.
Stankiewicz, M.J., (red). 2010. Pozytywny potencjał organizacji, Wstęp do użytecznej teorii zarządzania. Toruń, Dom Organizatora.
Śliwczyński, B., (red). 2015. Modelowanie systemu zarządzania przepływem materiałów i oceny efektywności procesów. Poznań, Wyższa Szkoła Logistyki.
Tseng, Y.Y., Yue, W., Taylor, M. 2005. The role of transportation in logistics chain. Proceedings of the Eastern Asia Society for Transportation Studies, 5, 1657-1672.
Wallace, T., Stahl, R.A. 2008. Sales and Operations planning. Third Edition, T.F. Wallace & Company.
Wang, X., Sha, Z., Kwong, K. 2008. Effects of brand image and manufacture-3PL relationship on 3PL satisfaction: a Theoretical Framework, 4th International Conference On Wireless Communications. Networking and Mobile Computing, 1-31.
Waters, D. 2001. Zarządzanie Operacyjne Towary i usługi. Warszawa, PWN.
Weckenmann, A., Brenner, P. 2006. A Process Modelling Approach For Design of Experiments. Information Control Problems in Manufacturing – INCOM, 799-802.
Werbiń, S. 2008. Model logistycznego wsparcia systemu eksploatacji środków transportu. Politechnika Wrocławska Instytut Konstrukcji i Eksploatacji Maszyn.
Węglarz, J. 1981. Sterowanie w systemach typu kompleks operacji. Warszawa–Poznań, PWN.